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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/042,911	01/09/2002	Shana O. Kelley	2846/1032	4527
29932	7590	11/10/2003		
PALMER & DODGE, LLP PAULA CAMPBELL EVANS 111 HUNTINGTON AVENUE BOSTON, MA 02199			EXAMINER FORMAN, BETTY J	
			ART UNIT	PAPER NUMBER
			1634	

DATE MAILED: 11/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/042,911	KELLEY ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	BJ Forman	1634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 August 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-59 is/are pending in the application.
- 4a) Of the above claim(s) 44-59 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-43 is/are rejected.
- 7) ☒ Claim(s) 1 12 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 January 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                      | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____              |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                             | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>10/02</u> . | 6) <input checked="" type="checkbox"/> Other: <i>Notice to Comply w/ N.A. Sec Rules</i> |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election with traverse of Group I, Claims 1-43 in papers filed 19 August is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse and therefore made final (MPEP § 818.03(a)).

### ***Drawings***

2. The drawings are objected to because Fig. 16 contains a nucleic acid sequence which is not identified by a SEQ ID NO: as required 37 C.F.R. §§ 1.821(d).

**A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application.** The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

3. Claims 1 and 12 are objected to because of the following informalities:

- a. Claim 1 is objection to because the syntax is correct i.e. “**a proximal and distal ends**”.
- b. Claim 12 is objected to because the syntax is correct i.e. “**a electrically**”.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-43 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Claims 1-23 are indefinite in Claim 1 for the recitation “said proximal ends being attached to a substrate” because it is unclear whether the proximal ends are attached to the substrate or whether the recitation is a method step for attaching the proximal ends at some time in the future. It is suggested that the claim be amended to clarify e.g. delete “being”.

b. Claims 1-23 are further indefinite in Claim 1 for the recitation “further comprising a metallic material” because it is unclear whether the recitation modifies the substrate, the tubule or the device. IT is suggested that the claim be amended to clarify e.g. before “further” insert “said tubule” (page 9, lines 15-17).

c. Claim 11 is indefinite for the recitation “said substrate is a metallic or non-metallic material” because the recitation seems to define the substrate as being any material and therefore it is unclear what limitations are being imposed by the recitation.

d. Claims 14 is indefinite for the recitation “said biologically occurring compound immobilized on the surface of the metallic material” and because the recitations “biological occurring compound”, “immobilized on the surface”, “the surface of the metallic material” and “individual nanotubes” all lacks proper antecedent basis in Claim 1. It is suggested that the claims be amended to provide proper antecedent basis.

Art Unit: 1634

e. Claim 14 is further indefinite for the recitation “wherein.....comprising the carbon nanotube array” because the syntax is confusing and therefore, it is unclear how the recitation further limits the biological compound.

f. Claim 16 is indefinite for the recitation “at least two nanotubes in the said array by the surface immobilized biological compound” because both “nanotubes” and “surface immobilized biological compound” lack proper antecedent basis in Claim 1. It is noted that Claim 1 recites “a nanotube array comprising at least one nanotube” as such the array comprises nanotubes, not nanotubes. The recitation is further indefinite because “the said” is redundant.

g. Claims 24-43 are indefinite in Claim 24 because the claim contains two periods. Therefore, it is unclear what limitation are encompassed by the claim.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-5, 7-8, 11-12, 14-22, 24-27, 29-30, 33-39, 41-43 are rejected under 35 prevent nanotube from being denatured (Column 6, lines 46-49). U.S.C. 102(b) as being anticipated by Colbert et al (WO 98/05920, published 12 February 1998).

Regarding Claim 1, Colbert et al disclose a carbon nanotube array device comprising at least one nanotube with a proximal end and a distal end, said proximal end attached to a substrate and said tubule further comprising a metallic material (page 38, line 25-page 39, line

Art Unit: 1634

23 and Fig. 8). The recitation “capable of providing a surface for binding biological compounds coated or adsorbed thereof” does not describe or define structural components of the device but instead describes an intended use of the device.

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

While, the recitation is not afforded any patentable weight, it is noted that Colbert et al teach their device is capable of providing a surface as recited (see page 21, line 20-page 22, line 6 and Claims 46-48).

Regarding Claim 2, Colbert et al disclose the device comprising at least one pair of aligned tubules positioned proximally on a substrate (page 38, line 25-page 39, line 5 and Fig. 8). The recitation of intended use (i.e. such that their distal ends “are capable” of being bridged by a material) does not describe or define the structure.

Regarding Claim 3, Colbert et al disclose the device wherein the tubule is a single wall or multi-wall carbon nanotube (page 6, lines 20-22).

Regarding Claim 4, Colbert et al disclose the device wherein the metallic material comprises at least one metallic compound e.g. nickel or copper (page 8, lines 14-16).

Regarding Claim 5, Colbert et al disclose the device wherein the metallic material comprises at least one metallic compound e.g. nickel, platinum or cobalt (page 41, lines 19-21).

Regarding Claim 7, Colbert et al disclose the device wherein the metallic material is located at the distal end of the tubule i.e. the metallic material is integrated during tubule growth and therefore is at the distal end as well as throughout the tubule (page 41, lines 3-24).

Regarding Claim 8, Colbert et al disclose the device wherein the metallic material is present as a surface coating (page 14, lines 23-29)

Art Unit: 1634

Regarding Claim 11, Colbert et al disclose the device wherein the substrate is a metallic or non-metallic material (page 39, lines 3-5 and Fig. 8).

Regarding Claim 12, Colbert et al disclose the device wherein the substrate is an electrically semi-conducting material e.g. gold, mercury (page 6, lines 26-page 7, line 23; page 39, lines 3-7; and Fig. 8).

Regarding Claim 14, Colbert et al disclose the device further comprising at least one biological molecule (page 21, line 20-page 22, line 6 and page 24, lines 1-7).

Regarding Claim 15, Colbert et al disclose the device further comprising at least one biological molecule (page 21, line 20-page 22, line 6 and page 24, lines 1-7). The recitation of intended use (i.e. "is capable of conducting an electrical charge") does not describe or define the structure.

Regarding Claim 16, Colbert et al disclose the device wherein an electrical contact is established between at least two nanotubes in the array i.e. via attachment to the support, an electrical contact is established between the nanotubes (page 7, lines 4-21).

Regarding Claim 17, Colbert et al disclose the device wherein the biological compound is immobilized via surface adsorption, ionic bonding (e.g. enzyme-moiety binding), hydrogen bonding (e.g. hybridization) or covalent bonding (page 23, line 1-page 24, line 7).

Regarding Claim 18, Colbert et al disclose the device wherein the biological compound is chemically derivatized to include a linker e.g. thiol, or disulfide (page 35, lines 17-28 and page 39, lines 7-11).

Regarding Claim 19, Colbert et al disclose the device wherein the biological compound is chemically derivatized to include a linker i.e. thiol (page 35, lines 17-28).

Regarding Claim 20, Colbert et al disclose the device wherein the compound is a nucleic acid, amino acid, enzyme, protein or derivatives thereof (e.g. page 23, line 6-page 24, line 7).

Art Unit: 1634

Regarding Claim 21, Colbert et al disclose the device wherein the biological compound is a derivatized nucleic acid, amino acid, enzyme, protein, or segment thereof (e.g. page 23, line 6-page 24, line 7 and 39, lines 7-11).

Regarding Claim 22, Colbert et al disclose the device wherein the biological compound is DNA (page 24, lines 4-7).

Regarding Claim 24, Colbert et al disclose a sensor device comprising a carbon nanotube array comprising at least one pair of carbon nanotubes that further comprise a metallic material and a surface immobilized layer of at least one sensor agent depositing on the nanotubes (page 38, line 25-page 39, line 23 and (page 41, lines 19-21).

The recitation of intended use (i.e. "so as to provide an electrical contact between said pair of carbon nanotubes, said electrical contacts being capable of conducting an electrical charge wherein said sensor agent is capable of interacting with a target species so as to produce a change in electrical conductivity of the said sensor device") does not describe or define the structure and therefore is not afforded any patentable weight. However, it is noted that Colbert et al teach these functions (page 23, line 1-page 24, line 7).

Regarding Claim 25, Colbert et al disclose the device wherein the tubule is a single wall or multi-wall carbon nanotube (page 6, lines 20-22).

Regarding Claim 26, Colbert et al disclose the device wherein the metallic material comprises at least one elemental metal, metallic alloy or combination e.g. nickel or copper (page 8, lines 14-16).

Regarding Claim 27, Colbert et al disclose the device wherein the metallic material is selected from e.g. nickel, platinum or cobalt (page 41, lines 19-21).

Regarding Claim 29, Colbert et al disclose the device wherein the metallic material is located at the distal end of the tubule i.e. the metallic material is integrated during tubule growth and therefore is at the distal end as well as throughout the tubule (page 41, lines 3-24).



Art Unit: 1634

Regarding Claim 30, Colbert et al disclose the device wherein the metallic material is present as a surface coating (page 14, lines 23-29).

Regarding Claim 33, Colbert et al disclose the device wherein an electrical contact is established between at least two nanotubes in the array i.e. via attachment to the support, an electrical contact is established between the nanotubes (page 7, lines 4-21).

Regarding Claim 34, Colbert et al disclose the device wherein the biological compound is immobilized via surface adsorption, ionic bonding (e.g. enzyme-moiety binding), hydrogen bonding (e.g. hybridization) or covalent bonding (page 23, line 1-page 24, line 7).

Regarding Claim 35, Colbert et al disclose the device wherein the biological compound is chemically derivatized to include a linker e.g. thiol or disulfide (page 35, lines 17-28 and page 39, lines 7-11).

Regarding Claim 36, Colbert et al disclose the device wherein the biological compound is chemically derivatized to include a linker i.e. thiol (page 35, lines 17-28).

Regarding Claim 37, Colbert et al disclose the device wherein the compound is a nucleic acid, amino acid, enzyme, protein or derivatives thereof (e.g. page 23, line 6-page 24, line 7).

Regarding Claim 38, Colbert et al disclose the device wherein the biological compound is a derivatized nucleic acid, amino acid, enzyme, protein, or segment thereof (e.g. page 23, line 6-page 24, line 7 and 39, lines 7-11).

Regarding Claim 39, Colbert et al disclose the device wherein the biological compound is DNA (page 24, lines 4-7).

Regarding Claims 41-43, Colbert et al disclose the device wherein the device senses and detects various biological compounds (page 21, line 20-page 22, line 6 and page 23, line 1-page 24, line 7). However, it is noted that the recitation intended use "capable of sensing and detecting..." does not describe or define the structural components of the device.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al (WO 98/05920, published 12 February 1998) in view of Deguchi et al (U.S. Patent No. 6,400,091, filed 14 March 2000).

Regarding Claim 6, Colbert et al disclose a carbon nanotube array device comprising at least one nanotube with a proximal end and a distal end, said proximal end attached to a substrate and said tubule further comprising a metallic material (page 38, line 25-page 39, line 23 and Fig. 8) wherein the metallic material is selected from one of several metals e.g. nickel, platinum or cobalt (page 41, lines 19-21) but they do not teach the metallic material is gold. However, it was well known in the art at the time the claimed invention was made that carbon nanotube preferably contained gold as taught by Deguchi et al (Column 6, lines 39-61) wherein the addition of metals such as gold prevent nanotube from being denatured (Column 6, lines 46-49). It would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the nanotubes of Colbert et al by incorporating gold as taught by Deguchi et al for the expected benefit of preventing the nanotubes from being denatured as taught by Deguchi et al (Column 6, lines 46-49).

Art Unit: 1634

10. Claims 9, 10, 23, 31, 32 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al (WO 98/05920, published 12 February 1998) in view of Massey et al (U.S. Patent No. 5,866,434, issued 2 February 1999).

Regarding Claims 9, 10, 31 and 32, Colbert et al disclose a carbon nanotube array device comprising at least one nanotube with a proximal end and a distal end, said proximal end attached to a substrate and said tubule further comprising a metallic material (page 38, line 25-page 39, line 23 and Fig. 8) but they do not teach the device wherein the metallic material is particulate (e.g. bead) and at a terminal end of the nanotube. However, Massey et al teach a similar device comprising at least one nanotube comprising metallic material at a terminal end wherein the metallic material is a magnetic bead (Column 54, a lines 1-20). Massey et al further teach the magnetic bead at a terminal end "dramatically" improves the surface area (Column 54, lines 5-8) and are "extremely useful" for separation assays (Column 52, lines 36-42). Therefore, it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the nanotubes of Colbert et al by providing a magnetic bead at a terminal end as taught by Massey et al for the expected benefit dramatically improving surface area and easy separation as taught by Massey et al (Column 52, lines 36-42 and Column 54, lines 1-20).

Regarding Claim 23 and 40, Colbert et al teach the device wherein the biological compound is DNA (page 24, lines 4-7) but they are silent regarding the DNA being single-stranded. However, Massey et al teach the similar device wherein the biological compound is single-stranded DNA (Column 53, lines 52-67) whereby the DNA probe assays are performed with dramatically improved surface area (Column 54, lines 1-20). It would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to apply the single-stranded DNA of Massey et al to the DNA taught by Colbert et al for the expected benefit of performing DNA probe assays with dramatically improved surface area as taught by Massey et al (Column 54, lines 1-20).

Art Unit: 1634

11. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al (WO 98/05920, published 12 February 1998) in view of Chuang et al (U.S. Patent No. 6,062,931, issued 17 May 2000).

Regarding Claim 13, Colbert et al disclose a carbon nanotube array device comprising at least one nanotube with a proximal end and a distal end, said proximal end attached to a substrate and said tubule further comprising a metallic material (page 38, line 25-page 39, line 23 and Fig. 8) wherein the nanotubes are bound to the substrate (page 39, lines 3-8 and Fig. 8 #804) but they are silent regarding the composition of the substrate. However, it was well known in the art at the time the claimed invention was made that silicon is the preferred substrate material for binding nanotubes as taught by Chuang et al (Column 1, lines 61-67). Therefore, It would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to apply the silicon substrate of Chuang et al to the substrate of Colbert et al for the expected benefit of providing for the most effective nanotube binding as taught by Chuang et al (Column 1, lines 61-67).

#### **NOTICE TO COMPLY WITH NUCLEIC ACID SEQUENCE RULES**

12. This application (Fig. 16) contains sequence disclosures that are encompassed by the definitions for nucleotide and/or amino acid sequences set forth in 37 C.F.R. § 1.821(a)(1) and (a)(2). However, this application fails to comply with the requirements of 37 C.F.R. §§ 1.821-1.825 for the reason(s) set forth on the attached Notice To Comply With Requirements For Patent Applications Containing Nucleotide Sequence And/Or Amino Acid Sequence Disclosures.

Art Unit: 1634

APPLICANT IS A PERIOD OF TIME WHICH IS CO-EXTENSIVE WITH THE TIME TO REPLY TO THIS OFFICE ACTION WITHIN WHICH TO COMPLY WITH THE SEQUENCE RULES, 37 C.R.F. §§ 1.821-1.825. Failure to comply with these requirements will result in ABANDONMENT of the application under 37 C.F.R. § 1.821(g). Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 C.F.R. § 1.136. In no case may an applicant extend the period for response beyond the six month statutory period. Direct the response to the undersigned. Applicant is requested to return a copy of the attached Notice to Comply with the response.

### **Conclusion**

13. No claim is allowed.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to BJ Forman whose telephone number is (703) 306-5878. The examiner can normally be reached on 6:30 TO 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gary Benzion can be reached on (703) 308-1119. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 308-8724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0196.



BJ Forman, Ph.D.  
Primary Examiner  
Art Unit: 1634  
November 5, 2003